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3. Changes and development of Hungarian national innovation system

Éva Gajzágó – Gergő Gajzágó

During the last two decades basic changes were made in the Hungarian system of institutions and also in the national innovation system (NIS). The main institutions were founded after the regime change and since then the system was continuously changing.

This recent article aims to introduce the Hungarian innovation system and its changes in the last two decades. The introduction focuses on the structures and participants of the NIS (like the organizations participating in the innovation process and the decision makers of the innovation policy). The article also aims to reveal the financing mechanism and the target groups of the NIS organizations. Highlighting of the correspondence of the NIS and the priorities of national and EU development strategies and programs was also a main goal of the research.

Keywords: national innovation system, organization, financing

1. Introduction

Our article is based on the theory which states that one of the key elements of the development of national economies is to increase the innovation potential. The long term development of a region is influenced by its innovation potential and innovation capability - ability of adaptation, number of innovative companies, knowledge transfer and creation, innovative milieu, etc. (e.g. Perroux 1955, Lasuén 1971, Schumpeter 1980, Rechnitzer 1993, Capello 2006). Governments can support the increase of this potential through the establishment and development of innovation system with several complex assets (Flanagana et al. 2011, Arocena-Sutz 2002). This development should be based on organizational cooperation and the systems of knowledge creation and transfer (Szépvölgyi 2006, Nagaoka et al. 2009).

Recent article aims to give an overview of the Hungarian innovation system and its actors - the organizations participating in the innovation process -, examining four period from the socialist era till 2015. The authors in every period are focusing on the decision making structures and participants of the system, examine the financing mechanism of the organizations and the hindering problems of innovation. The article is based on the related literature - previous secondary research results - and a complex empirical research containing three main analyses. One analyses examined the national and EU grants promoting the innovation process. The second research focused on the national and European Union

development strategies and the third one was a national level primer research questioning the intermediary organizations of the innovation process (like technology transfer offices, chambers of commerce or regional innovation agencies)[1].

The first part of the article introduces the main literature and the definition of the national innovation system and the participants of the NIS. The main part of the study contains the results of the above mentioned three researches and summarizes the development of the innovation system in Hungary by four stages: 1. the national innovation system before the regime change, 2. between 1989 and 2004, 3. between 2004 and 2010 and 4. the innovation system nowadays after 2010.

2. About the national innovation system and its actors

Since the last century several experts in economics and regional economics indicated that innovation has an important role in regional development. Schumpeter (1980) highlighted that the innovation stimulates the regional goal. Perroux (1955) wrote about development centers (poles) in which the motoric elements are the innovative sectors of knowledge creation. Lasuén (1971) emphasized the adaptation of innovation which influences the structure of the region and cities. He also adds that the economic development originates from the flow of technology change and thus the development process is due to the innovation process.

Several articles – like Freeman (1987, 1995), Filippetti and Archibugia (2011), OECD (2005) – define and describe the national innovation system. Freeman (1987) defines the NIS as the network of the public and private institutions which have a leading role in the creation and spreading inventions and innovation. According to the definition of the Oslo Manual (OECD, 2005) the NIS consist of private and non-private (public) organizations, which influence the direction and velocity of the innovation process. Filippetti and Archibugia (2011) gives an overall picture about the NIS definitions in the literature. They also confirm that the innovation processes of the companies are significantly influenced by those systems, which promote innovation partnership, patenting, financial processes and higher education.

[1] The primer research – between 2010 and 2013 - examined the intermediaries of the innovation process on several levels: on national level - by analysing statistical data, and with a questionnaire survey -, on regional level - by regional level survey which measured the cooperation of companies in the Hungarian Central-Transdanubian Region with questionnaires and in-depth interviews and on local level - with questionnaires surveying the cooperation of local companies and researchers in the Hungarian Dunaújváros sub-region.

Regarding to the Hungarian NIS several literature can be found – like Dőry (1998, 2005), Inzelt (1998), Molnár (2004), Török (2006), Buzás (2007), Smahó (2008), Lengyel and Leydesdorff (2008), Inzelt and Szerb (2003), Lux (2013) and the articles of Csizmadia, Grosz and Szépvölgyi (2002, 2004, 2008, 2011). Inzelt (1998) defines the NIS according to a narrow and a wider perspective. Buzás (2007) emphasizes the role of government in the innovation process and also explains assets which the government can use to promote innovation. Molnár (2004) and Smahó (2008) define and classify the actor of the NIS. Some of the above mentioned literature closely examines the innovation system and its participants in the regions of Hungary (e.g. the articles of Csizmadia, Grosz and Szépvölgyi (2002, 2004, 2008, 2011, Dőry 1998, Inzelt – Szerb 2003). Lux (2013) focuses on the innovation actors of three Hungarian cities. On the contrary, Hungarian literature does not contain articles about the overall changes and structure of the national NIS.

3. Innovation and R&D in Hungary before the regime change

This chapter describing the innovation system before the regime change is based on the literature (Honvári 1997, 2006, Kaposi 2004) about the economic history of Hungary and an interview with the former development director[2] of the biggest metallurgical company of Hungary, the Dunai Vasmű.

In the socialist system, Hungarian economy was excessively centralized, planned and bureaucratic. (Honvári 1997). The main institute of the economy was the National Planning Office and several other public offices (like the Economic Main Council, the Industrial Ministry, or the National Material and Price Office) influenced the management – and therefore the R&D – of companies. The system was complex, hierarchical and consisted of too many public organizations (e.g. ministries and 29 industrial directories plus 19 county affiliates of the planning offices).

The Comecon (Council for Mutual Economic Assistance, in Hungarian: KGST) also had an effect on R&D. International contracts were 'translated' to the company and manufacturing level by companies' research departments, which were also responsible for the elimination of problems and for the examination of international technology trends. Furthermore, companies also cooperated with local higher educational institutes to accomplish the plans of the Comecon and the national planning office. This partnership was

[2] Interview with Gyula Králik, former development director if the Dunai Vasmű. The interview was made in September 2007.

obligatory and legally based on the act of 1961 (act on the Hungarian educational system). Comecon agreements also forced the member states to develop only in a specific sector of industry. Therefore, some sectors (and their R&D process) which were prosperous before – like communication engineering or the manufacturing of railway carriages –, and which were not stated in the agreements, started to decay. Comecon influenced the licensing process too, as its member countries had to share their inventions without payment. Therefore until 1971 all countries shared only unremarkable licences (Honvári 2006).

During the soviet era, some organizations were founded which also played a significant role after the regime change. The National Technological Development Committee (in Hungarian: OMFB) e.g. was established in 1962 and operated until 2000. It was responsible for the international network of scientific and technological attachés and for funds for technological development.

Financing of R&D was centralized but companies could receive funds from three main funds; from the government, from public banks and from public company development funds (from 1968). In 1986 a specific fund for supporting basic research in Hungary was founded. The National Scientific Research Fund (in Hungarian: OTKA) is still available for researchers and from 1997 is legalized and supervised by a specific law[3]. The National Patent Office was established much before the socialist era in 1895 and is still functioning.

Inventions and innovation were hindered by the bureaucratic coordination, by the 'profilization' (separation of processes which were not closely connected to the manufacturing stage) and by the separation of economic sectors (Honvári 2006).

After the 1950s, Hungarian economy aimed to focus on the heavy industry[4]. Raw materials were imported from other soviet states which did not reached the required quality for the manufacturing process. This was a huge burden for the companies but interestingly increased the number of inventions. Companies and their experts had to fulfil the national plans thus regularly transformed the manufacturing process or the product itself using R&D.[5]

During this period - as in nowadays (see the recent works of Nagaoka et al. 2009, Guana − Chen, 2012, Inzelt – Szerb 2003), personal connections and networks were significant for

[3] act CXXXVI. of 1997.
[4] act II. of 1951. on the fives years plan,
[5] In the Dunai Vasmű – the largest metallurgical company in Hungary - the quality and quantity of the imported input raw material (iron ore) was low however the national plan clearly defined the quality and quantity of output – according to the Comecon the company had to produce tractors and agricultural machines. Besides, with the given manufacturing capacity the firm could not have possibility to increase or develop the quality of the manufacturing assets. These – and the aim to gain profit or decrease the loss – forced the company to invent new technologies and frequently change the manufacturing process which was only possible to accomplish by inner development.

researchers. R&D task from companies were only obtained by experts who had personal partnership with companies.

After 1960s, higher educational research stared to secede from industrial needs as researchers were rather aimed to reach higher scientific degree with research results. This tendency was so significant that it influenced the motivation of researchers after the regime change too and some of the researchers only realized the importance of industry based research later, after 2004.

The Hungarian economy started to slightly develop in the 80s due to several reforms. Public companies were reorganized and launched more development programs. However, industrial and R&D differences between the socialist and so called western countries were obvious.

4. Hungarian innovation system in the 'transition' decade after the regime change

After the regime change in 1989, the transformation and reorganization of Hungarian economic system started explosively. Public leaders emphasized the importance of R&D and changed not only the legal base and strategic documents but the institutional[6] and financial system too. Unfortunately, during this reorganization, previously established institutions and systems were not examined and the transformations of systems were not based on extensive research about the possibilities or capabilities.

The OMFB[7] was closed. Despite of its closure, the board of OMFB and the successor of the organization[8] played a significant role in the elaboration of the first national innovation strategy. The first strategy was based on the No. 1089/2003 government enactment, about R&D and technological innovation. Science and Technological Policy College also participated in the elaboration of this document.

From the late 1990s more and more strategies and plans were elaborated to develop the R&D&I in Hungary. The National Development Plan (from 2004) and the New Hungarian Development Plan (from 2007)[9] contained priorities according to the reorganization of the innovation institutional structure.

[6] e.g. Hungarian Association for Innovation responsible for the innovation process and financing was established in 1990.
[7] National Technological Development Committee
[8] the R&D vice secretariat of the Ministry of Education
[9] Both plans were elaborated for the National Reference Framework, for receiving EU funds.

In 2003 the new innovation act[10] were published. The act established the National R&D Technology Office (in Hungarian NKTH), the R&D and Technological Innovation Fund and the Research and Technological Innovation Council (in Hungarian: KuTIT). In this same year the Science and Technology Policy Counsellor Body (4T) was also founded. This organization consisted on experts from both scientific and business are and cooperated with the KuTIT.

Starting from the late 1980s, financial funds for investments and therefore for innovation were significantly decreased due to economic recession (Kaposi 2004). Companies had to decrease their R&D activities, some companies even ceased this activity. Public funding system was changed to tenders and grants.

From 2003, the innovation fund (the NKTH) was responsible for the distribution innovation allowance and government supports. The process was managed by the R&D Tender and Research Usage Office.

Nowadays research organizations and companies can receive funds from national and EU resources through project based calls. Some part of the innovation system like public research institutes is still financed directly but their share from funds is decreasing.

In this period, the elaboration of goals regarding to the national innovation system and the decision making process were directed by several organizations. Not only one ministry was responsible for the decision making - one part of the development process was supervised by the Ministry of Economy[11] and another part (e.g. the supervision of the Hungarian Science Academy (HSA)) by the Educational and Cultural Ministry. This sharing of tasks reflects the overly bureaucratic system of the socialist era. Since the millennium – up until today - in Hungary these tasks were always shared by two or three ministries[12].

Right before 2004, when Hungary joined the EU, there was an urgent need of the transformation of the national innovation system. Decision makers were obliged to meet the requirements of and close up to the European Union.

5. The innovation system after 2004

2004 was a turning-point for the development of Hungarian innovation system as the act CXXXIV of 2004 on the R&D and technological innovation was introduced. The law

[10] act XC. of 2003. on the research-development and innovation fund
[11] the Ministry of Economy and Transport from 2002
[12] the Ministry of Economy, the Educational Ministry and the National Development Ministry (from 2010)

assigned the National Research and Technological Office to be responsible for the innovation policy and strategy, for financing R&D processes through the Research and Technological Fund (in Hungarian: KTIA) and for the supervision of the TéT (scientific and technological) attaché network. The supervision of the NKTH was at ministry level in the Ministry of Economy. Other organizations and committees (e.g. HSA committees or the Higher Educational and Scientific Council) were also supporting the decision making process about the NIS but the real roles of these organizations were quite ostensible. The main decision maker was the ministry and the NKTH. The NKTH office launched several national funding programs and grants for financing the innovation process and its actors – like the National Technology Program, Mobility Grant or the Baross Gábor Program.

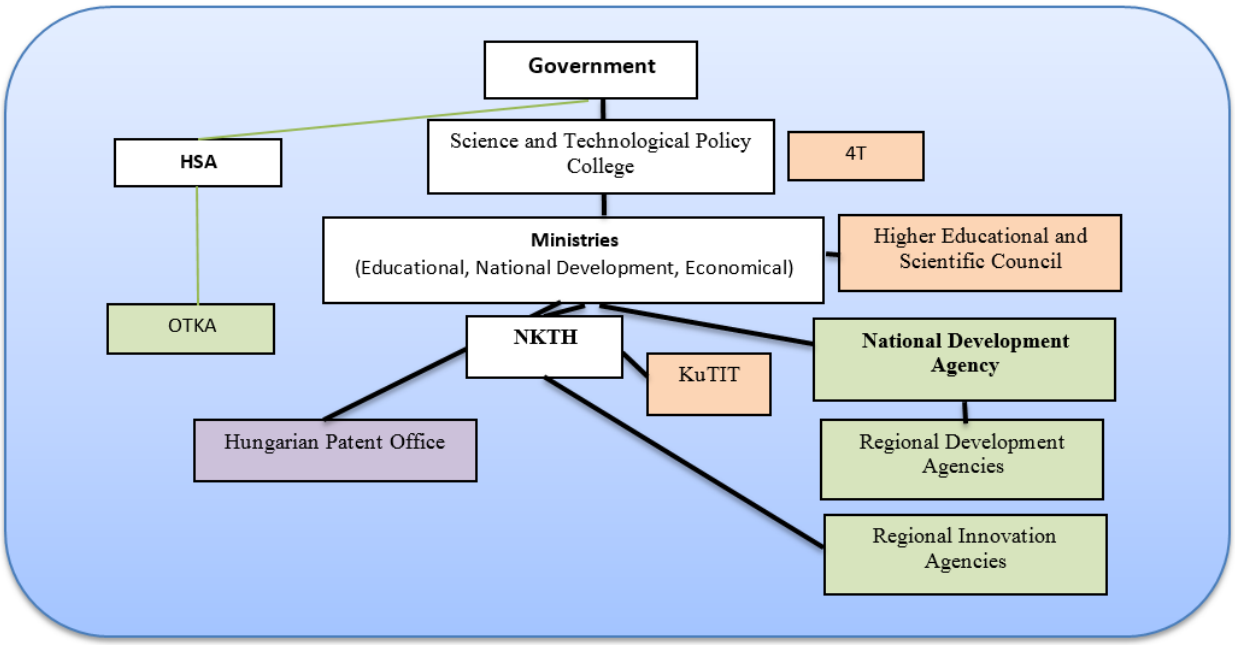
The regional distribution of EU funds for innovation development was coordinated by specific regional non-profit organizations, by the Regional Development Agencies. The agencies supervised the funded projects, but most of them could not effectively fulfil their innovation intermediary role.

In 2007 the government accepted the Middle Term Scientific, Technological and Innovation Political Strategy which aimed to establish and develop regional innovation networks and organizations – like technology transfer centres and regional innovation centres. Regarding to this program, Regional Innovation Agencies were founded in 2008. They were responsible for the management and cooperation of regional innovation networks and the collaboration of the regional actors of innovation. Innovation agencies between 2008 and 2010 were financed by the government through specific grants.

Hungarian Science Academy plays a significant and dual role in the Hungarian innovation system. In one hand, the academy influences the political and professional decision making process about innovation and participates in the elaboration of national level strategies. On the other hand, the HSA manages its own research centres and laboratories, thus participates in the innovation process as a knowledge creator.

After the regime change the Hungarian educational system was also reorganized which influenced not only the research process in the university labs, but the cooperation of institutes with business enterprises too. Regarding to the act CXXXIX of 2005 on the higher education and its modifications, higher educational institutes can establish their own enterprises to promote the marketing process of their own research results. Figure 1 summarizes the Hungarian NIS decision makers.

Figure 1 Main decision makers of the Hungarian NIS before 2010



Source: own construction based on Havas − Nyiri (2007)

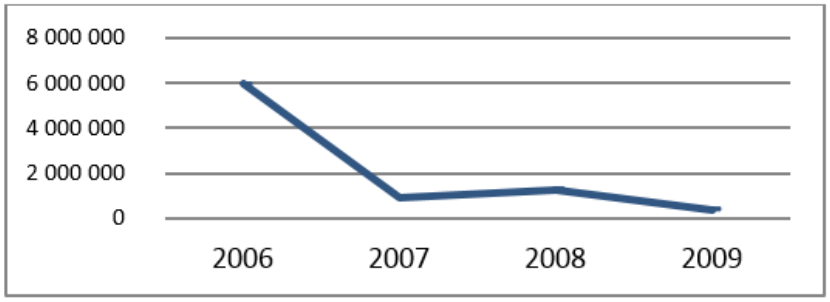
From 2007 there was some fragile initiative in the economic and innovation policy for decentralization. One of these initiatives was the so called Pólus Program aimed to increase the economic growth in seven Hungarian cities and promote the establishment and effectiveness of innovative clusters. This program clearly defined the sectors which the seven cities should emphasize and support. The program was based mainly on the 2007–2013 EU co-financed grants. Unfortunately, the Pólus Program could not reach its goals as it was not even launched due to several political and socio-economic reasons.

From the above mentioned Baross Gábor Program, actors of the innovation process received near HUF 8,5 billion between 2006 and 2009. Most of this sum – more than 70% of the total amount – was received by the organizations in the first year of the program. During the four years the support was gradually decreasing (Figure 2), in 2009 only organizations from three of the Hungarian regions could apply for funding of 363 million HUF. The gradually decreasing funds caused several management and organizational problems for the actors of the innovation network.

After 2004, when Hungary joined the European Union, further EU and national funds were accessible for the participants of the innovation process. EU funding was based on the New Hungarian Development Plan and New Széchenyi Plan. Between 2007 and 2013 the amount received by organizations from the co-financed grants exceeded HUF 91 billion. Besides, this amount also decreased gradually. Another hindering problem was – and is

nowadays -, that both EU co-financed calls and Baross Program's calls were project-based and were aiming to support specific activities.

Figure 2 Amounts received from Baross Program per year from 2006 to 2009



Source: own construction

In Hungary one of the hindering factors of innovation is the lack of trust (Inzelt − Szerb, 2003) therefore cooperation of organizations – e.g. in the above mentioned Pólus Program - failed or regional and local partnership could not work effectively. In our primary research we examined the cooperation of companies and innovation intermediary (bridge) organization in the Central-Transdanubean Region. Among the 300 respondent companies, more than 76% stated that the cooperation with public research institutes or centres would not develop their innovation process.

Other part of our research was focusing of the local level of a Hungarian region, the Dunaújváros sub-region in the Central-Transdanubean Region. The results[13] of this local research (see in Notes) also show the main hindering problems of the innovation system in this period.

[13] In this middle sized city of Hungary, after 2005 the organizations of the local innovation system were established rapidly (Gajzágó 2011). Local and sub-regional strategies were elaborated, containing goals about innovation. Local and regional decision makers founded the local innovation council. The municipality together with local companies and the local higher educational institute founded an incubator and an industrial park. The College of Dunaújváros created a new Technology Transfer Office in 2006 and a for-profit intermediary organization 2 years later. A non-profit organization (M8-Dunahíd Kft.) joining a local association (HÍD Association) launched a program financing innovative projects of the local firms. M8 Dunahíd Kft. was closely connected to the regional innovation agency as its local sub-point. This local example clearly shows how much the innovation system developed until 2010. The main strategies were elaborated, the necessary organizations were founded. Unfortunately, due to several reasons, the system was not functioning well enough. The reasons like the lack of trust and cooperation, the false positioning of the organizations, the decreasing and instable financial resources lead to sharp and inextricable problems.

6. The Hungarian innovation system in the last 5 years

In the first years of 2010s, Hungarian innovation policy slightly changed direction. While the European Union responded to the global financial and economic crisis with emphasizing the innovation in the EUROPE2020 strategy – stating the importance of the smart growth as the first priority – Hungarian decision makers seemed not to be obliged to these aims[14].

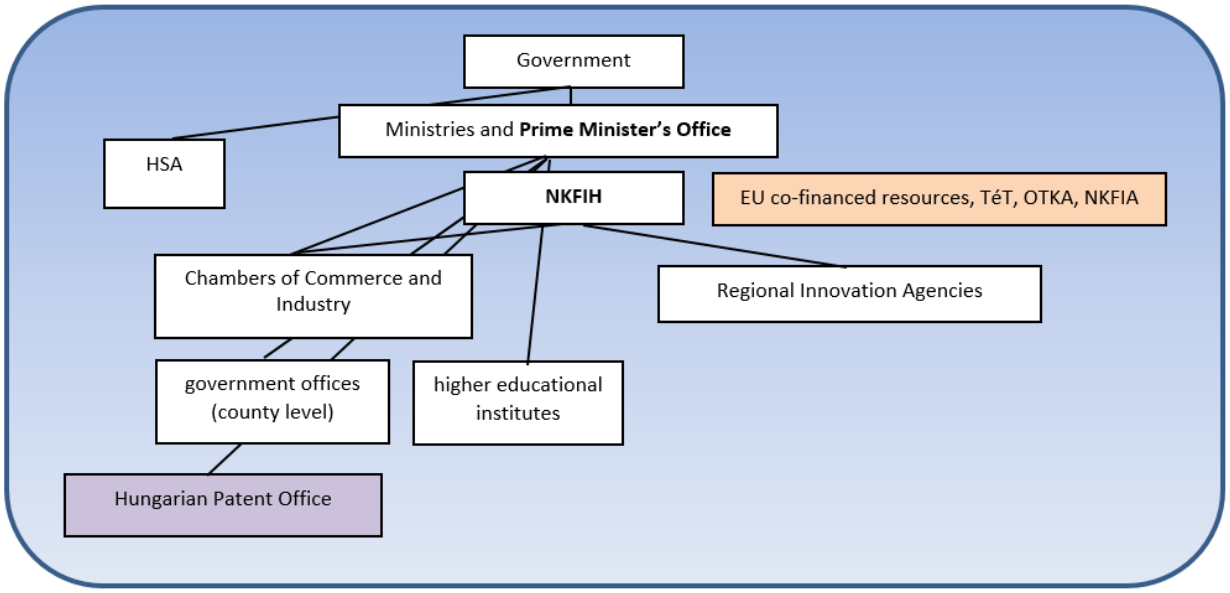
After this 'slow down' period, innovation decision makers started to follow EU priorities and innovation became an important question. Innovation policy's main goals were stated in the National R&D and Innovation Strategy published in 2013. In the strategy several goals are connected to the reform of the innovation system.

In 2014, accompanying the above mentioned strategy; the National Smart Specialization Strategy was published by the National Innovation Office. This strategy was also built on the financial support system of the EU and emphasizes the importance of EU funds. One year later, regarding to the act LXXVI. of 2014. on the scientific research and development and innovation, the National Innovation Office was transformed to National Research and Development and Innovation Office (in Hungarian: NKFIH). Not only the name of the organization was changed but due to a centralization process, more tasks – adopted from other organizations - were amalgamated in this institution. The NKFIH became responsible not only for the resources from EU innovation grants but for other Hungarian public funding – like the OTKA – too. The reorganization also concerned to other institutes. Industrial and Commercial Chambers were assigned to closely connect – with offering innovation services - to the NIS and also regional and county level institutions (e.g. government offices) and groups of experts joined the system with specific tasks. The recent structure (Figure 3) of the Hungarian organizations participating in the decision making about the NIS is the following:

Local and regional level innovation system has also changed since 2010. Many of the local and regional organizations were closed due to financial problems or strategical and political reasons. The sub-region we examined in our research has faced these problems too. The Technology Transfer Office of the local higher educational institute and the sub-point of the regional innovation agency were closed. The managing organization of this sub-point was bankrupted and closed down. The industrial park is not offering innovation services anymore and local financing of innovative firms has also terminated.

[14] On the general annual meeting of the Hungarian Association for Innovation (Garay et al. 2004), the political leaders emphasized that the government had more important issues to deal with than innovation.

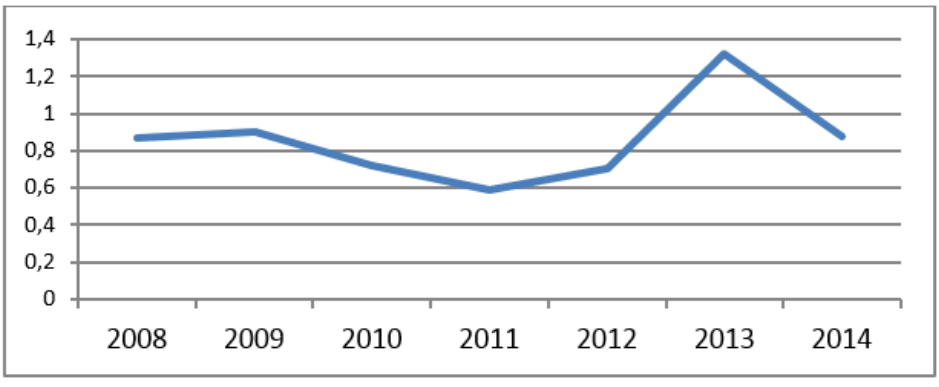
Figure 3 Main decision makers of the Hungarian NIS after 2010



Source: own construction

The Hungarian Patent Office is one of the oldest institutions of the NIS. Traditionally the legal authority of the Office was the Ministry of Economics but after 2010 the minister of justice is responsible the legitimacy of the organization. Besides, the patenting prices defined by the office are above the prices of other European countries which significantly hider the protection of Hungarian inventions. In the beginning of 2010s − from 2009 till 2012 − government budget on R&D was continuously decreasing as the below statistical data (Figure 4) shows.

Figure 4 Share of government budget appropriations or outlays on R&D



Sources: own construction by the data from EUROSTAT

EU Structural and Cohesion funds were also decreasing (as described in the previous chapter), and national grants' payments – like Baross Gábor Program grant – were delayed for

1.5 years. Therefore the participants of the NIS could not receive enough financial resources for their effective operation. After this recession, parallel with the increase of the EU financial support, government budget was also increasing.

7. Conclusions

The Hungarian innovation system between 1989 and 2010 was developed significantly. From the establishment of basic decision making and management institutions, till the structure of the founding process, the whole system was reorganized. Basic legal background of innovation was defined too. Innovation policy leaders and the leaders of organizations scrutinized the best practices of the European Union member countries. Several courses were organized e.g. where foreign experts taught Hungarian colleagues how to establish and manage technology transfer offices or incubators (Vekinis 2007). However, the reorganization was not based on the Hungarian or local best practices and previous organizations of the socialist system and only some of the institutes founded before the regime change are still functioning. The reorganized institutional system had parallel functioning organizations. Several decision making board (ministries) influenced and still influence the innovation process and the management of NIS institutions. Hungarian national innovation system after 2010 also had problems which hindered the innovation process. Decreasing commitment of political leaders, worldwide financial and economic crisis and drained financial support caused financial and management problems for the NIS organizations. Nowadays, Hungarian NIS's transformation is still in progress. Decision makers are committed to the development of the system however it became firmly centralized.

Transformation of NIS from the socialist era to the democratic system was not an easy process. During the last two decades, the legal base and the organizations of the NIS were successfully founded. To reach the goals about the increase of the innovation potential stated in the EU and national level innovation strategies, it is necessary to develop the efficiency of the system and its processes of participant organizations. In this article we tried to highlight some problems of the NIS. The solution of these problems can be based on the traditionally creative human resource or the values of the long existing R&D organizations. However, it is a difficult task to change the cultural and social milieu of the innovation. As Dahrendorf (1994) indicates, changing the political system requires 6 weeks, transformation of economy need 6 years but socio-cultural changes can only be realized in 60 years.

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